AFIT/GEE/ENV/99M-08

THE DETERMINANTS OF LOCATIONAL CHOICE FOR AIR FORCE MILITARY RENTERS: IMPLICATIONS FOR POLICY

THESIS

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AFIT/GEE/ENV/99M

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 1999	Master's Thesis, March 1999

4. TITLE AND SUBTITLE
THE DETERMINANTS OF LOCATIONAL CHOICE FOR AIR FORCE MILITARY RENTERS: IMPLICATION FOR POLICY

5. FUNDING NUMBERS

6. AUTHOR(S)

Eldrick L. Hill, Captain, USAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

AFIT/ENV
2950 P Street, Building 640
Wright-Patterson AFB, OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER

AFIT/GEE/ENV/99M-08

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Kenny Weldon, Major, USAF
AF/ILEH, Housing Division
1260 Air Force Pentagon
Washington, DC 20330-1260

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT

Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Housing allowances and military family housing make up approximately $7 billion dollars of the budget for the Department of Defense (DoD). The military uses a Housing Market Analysis (HMA) to determine rental housing availability around its installations. This thesis describes and analyzes the locational choices of military renters.

This thesis examines 16 bases in the continental U.S. using military and census data. It is concluded that the locational preferences of military renters vary inversely with distance from their duty location and this needs to be accounted for when assessing the availability of military rental housing. The implications of military renter locational preferences are also examined for travel costs and locational specific housing allowances.

14. SUBJECT TERMS

Military Housing; Geographic Information System; Private Sector Housing; Model Formulation

15. NUMBER OF PAGES
67

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

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THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Masters of Science in Environmental Engineering

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Captain, USAF

March 1999

Acknowledgements

I thank God for the knowledge, ability, and perseverance that he imparted to me during this process.

I would like to thank my wife who supported me and was understanding during the time consuming thesis process. Keisha was always there to lend a kind word and a thoughtful gesture when I needed it. I am forever indebted to her and she will always be in my heart.

I am truly grateful to my thesis advisor, Dr. H. Leroy Gill, whose guidance throughout the thesis process was priceless. His exceptional background in economics and statistical analysis helped pave the way for the contents of this thesis. After working so close with him I can truly say that without his assistance, this research would never have been completed. Thank you sir, for believing in this thesis and in me.

I would like to thank Dr. Yupo Chan for his insight and knowledge. His teachings gave me the idea for my thesis. He never turned me away when I needed to meet with him on any subject.

Finally, I would like to thank Lieutenant Colonel Stephen Lofgren for his input and time. His presence as department head, reader, teacher, and mentor made a distinct and positive impact on my time at AFIT.

Eldrick L. Hill

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Abstract

Housing allowances and military family housing make up approximately $7 billion dollars of the budget for the Department of Defense (DoD). The military uses a Housing Market Analysis (HMA) to determine rental housing availability around its installations. This thesis describes and analyzes the locational choices of military renters.

This thesis examines 16 bases in the continental U.S. using military and census data. It is concluded that the locational preferences of military renters vary inversely with distance from their duty location and this needs to be accounted for when assessing the availability of military rental housing. The implications of military renter locational preferences are also examined for travel costs and locational specific housing allowances.

THE DETERMINANTS OF LOCATIONAL CHOICE FOR AIR FORCE MILITARY RENTERS: IMPLICATIONS FOR POLICY

I. Introduction

"The Department of Defense (DoD) spends approximately $7 billion each year on housing allowances and its family housing for military families in the United States. Approximately two-thirds of the 900,000 military families living in the U.S. receive housing allowances that are used to rent or purchase housing in the private sector" (CBO, 1993, xi). The military attempts to meet the housing needs of the families that choose to live in the private sector by basing the housing allowance on the availability and cost of housing surrounding its Air Force installations. However, the availability and cost of civilian housing depends upon its location and the boundary that is utilized to determine the suitable units. Locational considerations have not been explicitly addressed in the military housing analysis. This thesis combines information on rental housing location, price, and distance from selected duty stations to model the locational decisions of Air Force renters.

Purpose of Thesis

In order to justify the need for military base housing, a Housing Market Analysis (HMA) of the civilian community is completed. As established by DoD policy, this analysis is only done for rental units. One key step in completing an HMA is determining the housing market area for an Air Force Installation. According to criteria in DoD 4165.63, September 1993 and Air Force guidance, the Military Housing Area (MHA) includes those dwellings where "the dwelling is within a one-hour commute by a private-

owned vehicle during normal commuting hours, or within other limits to satisfy mission requirements." The commuting time is measured from the military members' residence to the installation's headquarters building. The one-hour standard has the shortcoming of considering all rental units within the one-hour boundary to be equally weighted. This assumption ignores the greater transportation costs associated with the increased commuting distances. This thesis suggests a structured way to improve the HMA and provide a weighting system for rental units using spatially referenced census information.

Another neglected concern is the transportation cost from the residence of military members to their duty location. Military living in high cost areas are only compensated for the high cost through their housing allowance. However, this allowance only considers direct housing expenditures and ignores the possibility that some members may need to drive a considerable distance to find affordable rental housing. This study examines variations in actual commuting distances between various Air Force bases.

Outline of Upcoming Chapters

This document is structured as follows. Chapter 2 discusses the history of military housing and military housing programs. Chapter 3 graphically describes where military renters reside based on existing data. Included in this chapter is a description of the data set and an explanation of how the sample bases were selected. Chapter 4 presents the models of renter location choice developed in this research. Finally, Chapter 5 contains the conclusions and recommendations.

II. Military Housing Policy

Military Family Housing History

Since the earliest days of the American army, military housing has been in existence and it remains an important part of military life. Up to the beginning of World War II, the military provided family housing primarily for its small officer corps. Therefore only a small number of housing units were necessary to house officers and their families. Enlisted personnel serving during this time were housed in barracks because it was the perception of the military that many of these men were too young to have families. If the men that were drafted during times of war were married, they were expected to leave their families while they served (CBO, 1993:2).

The United States witnessed an unprecedented increase in the size of its military during World War II. The threat of communism after World War II convinced DoD that a much larger standing armed force was necessary. The nation could no longer depend on the small infrastructure of the past. The United States needed a constant military presence in order to fend off its cold war enemies. Out of this policy grew the need for a larger military housing inventory.

Just as the peacetime military grew after World War II, so did the percentage of servicemen who were married. The change in the size of the national defense force, along with the increased number of married service members, required an increase in military housing. "The Works Progress Administration built a modest number of homes in the 1930s, but the Wherry housing (construction) Program of the 1950s truly started the trend to increase the number of on-base military family housing units. The largest buildup of housing is attributed to the Capehart housing program, which began building

units in 1954 and continued until 1966" (CBO, 1993:3). An all-volunteer force transition in the early seventies saw another spurt of housing construction. The most recent large-scale housing construction was accomplished during the defense buildup under Reagan in the 1980s. The military continues to concern itself with housing, because it has long been believed that adequate housing is an important aspect of the military experience. "Military Family Housing (MFH) has long been considered one of the benefits of being in the Armed Forces. Senior leadership in the military has felt, and stated before Congress, that MFH has a direct effect on the career decisions of military personnel"(Bland, 1990: vi).

Base Housing Concerns

The housing of military members evolved into a quality of life issue for the DoD. For Air Force personnel not required to live on base, private housing is considered the primary source of housing. Recent studies show that it costs DoD more to maintain housing on base than it would to pay military members to live off base (CBO, 1993: 18). The military justifies housing members on base for diverse reasons. One explanation is location versus the mission. The mission of some bases calls for the base to be somewhat distanced from civilians (e.g. missile bases). Since adequate housing is normally sparse in that section of the country or the world, and recognizing that servicemen consider housing to be an important part of their lives, the military feels obligated to provide it. Also, essential personnel play a part in the rationale. Essential personnel are on call 24 hours a day and often required to report to their duty station as soon as possible. Housing given on base for these servicemen is a logical solution for diminishing the response time.

Air Force Housing Market Analysis

Since it is not the military's intent to house all of its members within the base proper, the significant step of deciding how much housing should be provided by the DoD comes into question. The Air Force Housing Market Analysis (HMA) was created to assist the Air Force in analyzing the housing markets around Air Force installations. "The purpose of the study is to determine the ability of the military housing area to meet the current and projected housing requirements (of the military members at their duty locations). Estimates of housing surpluses or deficits for the current and projected year are used in support of Air Force housing projects. The HMA, through its description and assessment of the housing market, also serves as a valuable resource for planning, even where government assets can house all military personnel" (HMA Guidance Manual, 1993: 1-2). Obviously, the adequacy of the housing market is dependent on the size and boundary of the housing market area.

Hired consultants use the HMA Guidance Manual to conduct the housing market analysis. As the title suggests, the manual guides and allows the consultants latitude in order to make a flexible document. Four steps outline the current process for defining the market area, which is supposed to be within one hour commuting time.

1. The analyst's preliminary estimate of the military housing area (in the form of a map) is sent to various local experts, such as a local transportation planning agency or the city planner, along with driving and traffic assumptions.
2. Local experts make any modifications based on their area of expertise.
3. The map is revised based on inputs of local experts.
4. When differences are not large, distances (estimated by different

experts/consultants) may be averaged to establish a military housing area (HMA Guidance Manual, 1993: 4-1).

These steps make no mention of how to establish the preliminary estimate referred to in step 1. Because the one-hour commute standard is the main guideline for establishing the housing market area boundary, the location of the boundary is highly subjective. A one-hour radius is difficult to ascertain because of varying congestion and traffic routes. The guidance does state that establishing military housing area boundaries along Census tract boundaries is highly encouraged. Census data is considered a valuable data source. This data may be used to establish a trend to help in forecasting changes in housing.

Supply and demand forecasts play a major role in forming the HMA. "The interaction of supply and demand works to determine the resulting quantity and price of housing supplied in a military housing area. Greater demand and increasing prices of existing housing units encourage additional housing. Additional housing is no longer added to the supply when the demand has been satisfied or when it is no longer profitable to construct housing at the going price" (HMA Guidance Manual, 1993: 5-3). The total housing supply contains all housing units within the housing market area excluding those unsuitable by Air Force standards. The exclusion of housing units decreases the estimated supply of civilian housing. Due to Air Force quality standards, some rental units are considered unsuitable for military families. The important point is that the HMA identifies deficits and surpluses of affordable rental housing units meeting Air Force standards. A deficit of such units shown within the HMA of an installation can be used to justify major projects within on-base housing of that same installation.

With regard to housing, military members have essentially three alternatives to

choose from: base housing, private ownership, or renting. Base housing is not addressed in this study. When considering housing quality, private owner-occupied housing is considered suitable housing by current Air Force guidance. The private rental market surrounding bases is the focus of this research. For renters, Air Force and DoD regulations specify minimum attributes for suitability in terms of location, price, amenities, type of housing, and safety issues. In the Housing Market Analysis, the housing price is defined to include only rent and essential utilities. The essential utilities included are gas, electricity, water, sewer, and garbage cost. Phone service and cable television are utilities that are excluded, because it is perceived that a household could live comfortably without these amenities. The sum of the rent and included utilities of each unit within the housing market area is compared to the Maximum Allowable Housing Cost (MAHC) to test for affordability. The MAHC is a term used in the Housing Market Analysis that establishes the maximum amount military families of each rank should pay for housing in that military housing area. In order to understand the significance of the MAHC, the history of housing allowances needs to be discussed.

Military Housing Allowances

After World War II, DoD planned to construct housing communities capable of housing all of its military members returning from World War II. A housing allowance system was enacted by DoD to compensate troops that had to live off-base, until there were enough on-base units to house those members. "When it became evident that housing construction could not satisfy 100% of the housing demand, the housing allowance system was expanded. In 1949, the Career Compensation Act established the Basic Allowance for Quarters (BAQ) system" (CBO, 1993:8). BAQ was based on a

member's pay grade and whether dependents were present. BAQ was not subject to local, state, or federal taxes. It was paid to all members that did not occupy government owned or leased housing and was location independent. The BAQ used the national average of what the different ranks paid for housing the year prior. DoD gathered this information by making it mandatory for military members to show proof of payment in the form of a lease agreement before they could receive BAQ. Realizing that regional location affects the price of housing, Congress enacted a Variable Housing Allowance (VHA) in 1980. VHA was founded on a survey that was again mandatory for all military personnel, which gave an indication of what different ranks were paying for rent or mortgage in different regions of the country. The local average from the survey was combined with the average utility cost to estimate the amount military families spent on housing in that area. The data was then segregated by ranks and the median of each rank was chosen. It was mandated that the sum of BAQ and VHA could not be greater than 75% of the established median housing expenditure for each rank (Hunter, 1997:62). In 1985, Congress enacted the goal of providing 85% of housing cost incurred by military members. The goal was not achieved, and the average family is presently reimbursed only 80% of their housing costs (CBO, 1993:8). "Evidence suggested that the current system of variable housing allowances did not compensate personnel adequately for regional differences in the price of housing" (CBO, 1993: 12).

The Air Force eliminated the survey in 1997, creating a new system that did not depend on a survey to establish the pay grades. The new system combined BAQ and VHA into one allowance named the Basic Allowance for Housing (BAH). Instead of using military data only, the BAH uses civilian census data to calculate the allowance.

The Air Force hired a consultant firm to calculate, every two years, a national average rental rate that included essential utilities using census data. Twenty percent of that figure is called the Maximum Out of Pocket Expense (MOPE). This is the amount military families are expected to pay out of base pay, which does not include their allowances. Then an average rental rate is established for every Central Business District (CBD) near an Air Force installation. For bases that are considered remote and not close to a CBD, the nearest CBD is used. Also, for bases that have more than one CBD near it, a weighted average is established. Each base takes its corresponding CBD rental rate and subtracts the MOPE. The figure that emerges is the BAH and it is established for every pay grade at each installation (Foster, 1998). The 1999 BAH rates for Wright-Patterson AFB are shown in table 1.

Table 1: 1999 Basic Allowance for Housing for Wright-Patterson AFB

	(Monthly in Dollars)	
Grade	With Dependents	Without Dependents
E1	475.00	339.00
E2	477.00	339.00
E3	497.00	366.00
E4	514.00	362.00
E5	598.00	430.00
E6	624.00	442.00
E7	702.00	512.00
E8	754.00	594.00
E9	838.00	636.00
O1E	672.00	513.00
O2E	758.00	611.00
O3E	821.00	682.00
O1	563.00	431.00
O2	632.00	510.00
O3	753.00	636.00
O4	909.00	750.00
O5	1024.00	818.00
O6	1086.00	902.00
O7	1086.00	902.00

Significance of Maximum Allowance of Housing Cost (MAHC)

In essence, the MAHC is used to identify which housing units in the military housing area are affordable for military members according to DoD established guidelines. A Maximum Allowable Housing Cost is calculated for each pay grade by adding the Basic Allowance for Housing and the Maximum Out of Pocket Expense, which is 20% of the CBD rental rate. The MAHC is compared to the sum of the rent and essential utilities for the rental units surrounding the base proper that are within the

subjective one-hour boundary. If this sum is greater than the MAHC, then, according to DoD standards, the rental unit is not included in the housing supply of suitable housing units. Quality factors, such as number of bedrooms, proper working essential utilities, and type of housing, are collectively used to eliminate any other unsuitable units. Therefore, the suitable rental supply is the total rental supply defined by the boundary minus the unsuitable rental housing and the number of natural vacancies. "Off-base housing supply available to the military is based on the proportion of military requirements. The methodology is based on the assumption that, in competitive housing markets, a military household has the same chance as a civilian household of securing a housing unit. It assumes that military households within a market segment will occupy housing units in proportion to the ratio of military households to the total households in the housing market area competing for housing units in that segment. This proportion determines the military share of the housing market segment" (CBO, 1993: 2-2). Very important from the standpoint of this thesis, this ratio is not adjusted for the distance rental units are from the Air Force base. Both the MAHC and the boundary set for the Military housing area will affect the estimated supply of rental housing. The number of suitable housing units (now labeled the supply) is compared to the number of military families in need of housing (the demand) to find out if the base has a deficit or surplus of housing units which is the main questioned asked by the HMA.

This chapter focused on the history of military housing, military housing allowances, and the purpose of the housing market analysis. Chapter three discusses the data set and examines the geographical distribution of military renters with regard to their duty locations.

III. Where Military Renters Live

Description of the Data Set

The data obtained in this study is constructed from two sources. The first database is from Mr. David Pomeroy of the Office of the Secretary of Defense (OSD) at the Pentagon (Pomeroy, 1998). His office used the 1997 VHA survey to extract several variables and place them in a database, which is referred to in this thesis as the Pentagon data. This database has roughly 60,000 individual observations corresponding to Air Force military members residing within in the Continental United States. Each observation includes the zip codes of the duty location and residence, the pay grade, whether the residence is rented or owned, and whether the member has dependents. The other database came in the form of Census CD+ Maps (GeoLytics, Inc., 1998). This software contains census data taken from the last census in 1990 as well as 1997 and 2002 estimates. This database also organizes information by zip code boundaries. The 1990 data measures over 240 variables including population and number of rental units. Census CD+ Maps identifies the latitude and longitude coordinates of all 1990 zip codes in the United States. The Pentagon and Census CD databases were merged into a SAS database.

Sample Selection

DoD's one-hour rule measures commuting by time. This research measures commuting by distance in miles from the resident zip code centroid to the duty zip code centroid because actual commuting time was not available for military members. Commuting time is found in the census data but it is recorded only by county and it represents average civilian commuting time to all work locations. Also, this recorded

commuting time can not be bound to reflect the commuting time to specific Air Force bases.

A 40-mile radius is used to encompass the locations of nearly all of the military renters. Only 0.7% of military households are located outside of this 40 mile radius. Distance is calculated using the latitude/longitude points for each residence zip code and its corresponding duty zip code.[1]

Sixteen of the larger Air Force bases were arbitrarily chosen. Table 2 lists the bases chosen for the sample by their duty zip codes with the corresponding total population and rental units that are within 40 miles. The sixteen bases differ in their Air Force missions and in proximity to major metropolis areas. Due to population growth, the United States Postal Service created new zip codes in 1996 in some areas. The Pentagon data was collected after the zip codes were changed, and the Census data was compiled in 1990, before the zip codes were changed. As a result, some respondent data contains resident zip codes for which Census CD+ Maps has no information.

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[1] The latitude/longitude points are given in degrees. The following formulas were utilized for the transformation.

$d2r = \text{atan}(1) / 45$ (1)

$x1 = x1 * d2r$ (2)

$y1 = y1 * d2r$ (3)

$x2 = x2 * d2r$ (4)

$y2 = y2 * d2r$ (5)

$arc = \sin(y2) * \sin(y1) + \cos(y2) * \cos(y1) * \cos(x2 - x1)$ (6)

$dist = 4000 * \arccos(arc)$ (7)

where,

d2r is transformation constant,

x1 is Resident zip code longitude,

y1 is Resident zip code latitude,

x2 is Duty zip code longitude,

y2 is Duty zip code latitude, and

dist is the distance between the centroid of the Duty and Resident zip codes

Table 2: Sample Bases for the Study

Duty Zipcode	Air Force Base	State	Total Population	Total Rental Units
20330	Andrews AFB	MD	5,297,022	774,446
28308	Pope AFB	NC	672,895	75,511
31699	Moody AFB	GA	230,005	25,072
45433	Wright-Patterson AFB	OH	1,521,290	175,539
68113	Offutt AFB	NB	740,098	93,257
72099	Little Rock AFB	AR	596,191	74,399
73145	Tinker AFB	OK	997,775	132,052
78150	Randolph AFB	TX	1,417,731	195,393
82005	F.E. Warren AFB	WY	114,036	15,619
84056	Hill AFB	UT	1,083,377	114,921
85309	Luke AFB	AZ	2,069,836	291,137
85707	Davis-Monthan AFB	AZ	669,843	101,693
89191	Nellis AFB	NV	729,170	135,639
94535	Travis AFB	CA	3,213,403	502,349
98438	McChord AFB	WA	2,076,430	332,676
99506	Elmendorf AFB	AK	262,180	41,982

Once the Pentagon data and the Census data were combined into the database used for this thesis, rank groups were established to assist in the analysis. The pay grades were divided into four distinct rank groups. Airmen through Staff Sergeant (E1-E4) were placed in rank group 1; Technical Sergeant through Chief Master Sergeant (E5-E9) in rank group 2; Second Lieutenant through Captain (O1-O3 which include officers through Captain with enlisted experience (O1E-O3E)) in rank group 3; and Major through General (O4-O10) in rank group 4. The construction of the rank groups combines pay grades with similar economic and demographic characteristics. The thesis database is limited to renters from these above sixteen bases. When completed, the database contained observations on 13,652 renters.

Distance Graphs

Because the thesis research hypothesizes that not all locational choices are equally likely, it is informative to graph the distance of military renters from their duty location. This distance is calculated from the centroid of the zip code in which the member resides to the centroid of the zip code in which the Air Force Base is located. The greater the area of the surrounding zip codes, the less accurate will be the calculated distance as an approximation of the actual commuting distance. Most likely, for bases with relatively few surrounding zip codes, the calculated distance over-estimates the actual commuting distance because military renters are probably found in parts of a zip code which are closer to the base. Figure 1 shows the proportion of all military members included in the sample at various distances.

Figure 1: Military Proportions for Sample Bases
Sample Size = 11699

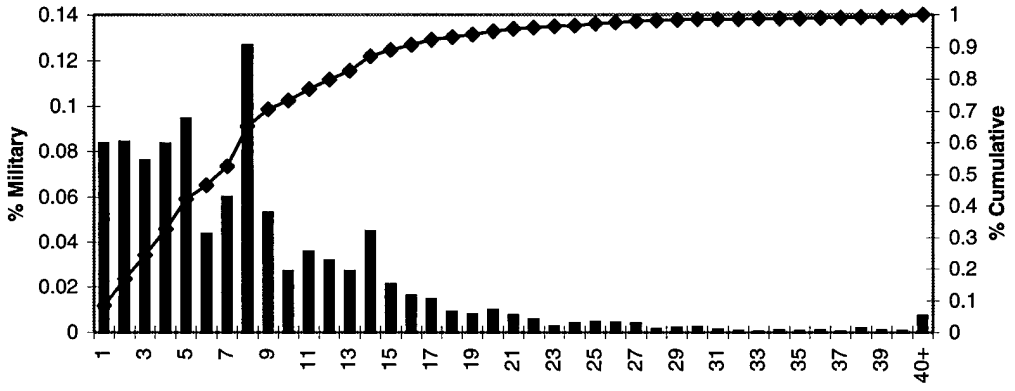
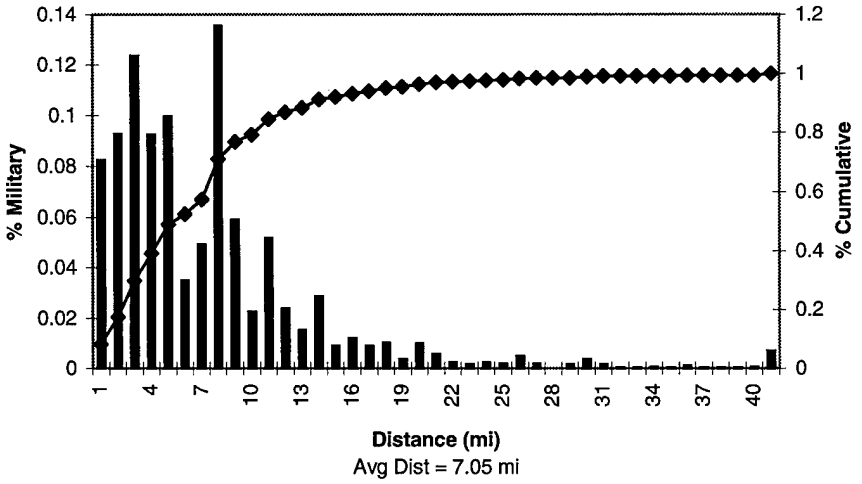


Figure 1 illustrates that more than half of the military families within the sample lives within seven miles of their duty location, while less than two percent live further than 27 miles from the base. Next, the military proportions were separated into the

aforementioned rank groups and compared. The comparisons are illustrated in figures 2 through 5.

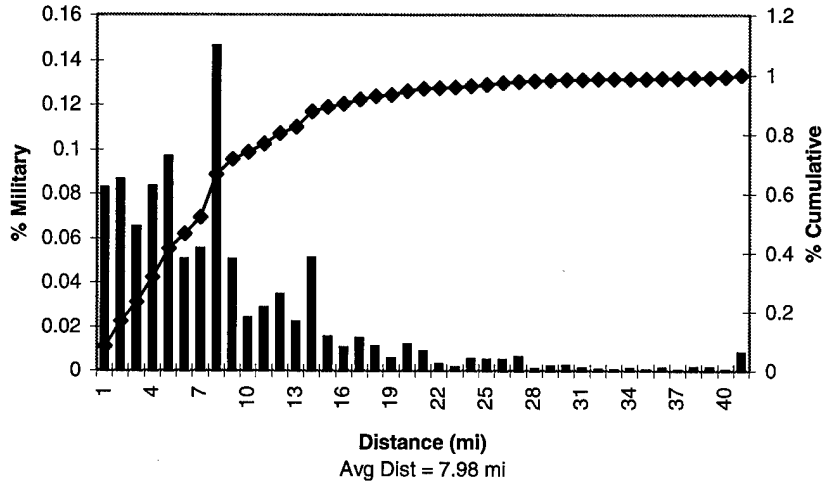
Figure 2: Rank 1 Military Proportion
Sample Size = 4650



More than 50% of military families in rank group 1 live within five miles of the base, which is closer than the average for all rank groups. There is a lull in miles six and seven, but the highest single proportion is in mile eight.[2] The cumulative graph shows a steep incline but then it flattens. This indicates that the young enlisted tend to locate relatively close to the base.

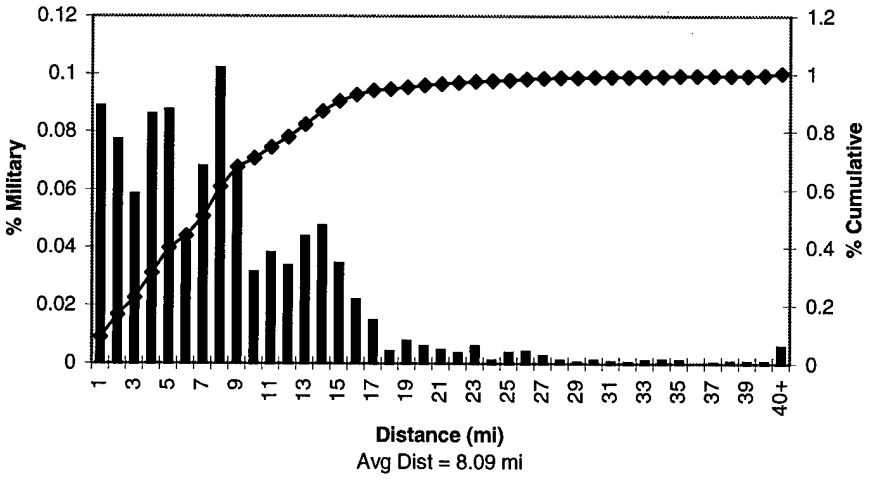
[2] This is most likely an artifact of this particular sample or the approximate manner in which distance is calculated.

Figure 3: Rank 2 Military Proportion
Sample Size = 4552



Rank group 2 reaches the 50% mark at mile 7---the overall average. Once again, there is a sharp increase eight miles away from the duty station. The cumulative graph is not as steep as that of rank group 1 and the distribution is more spread.

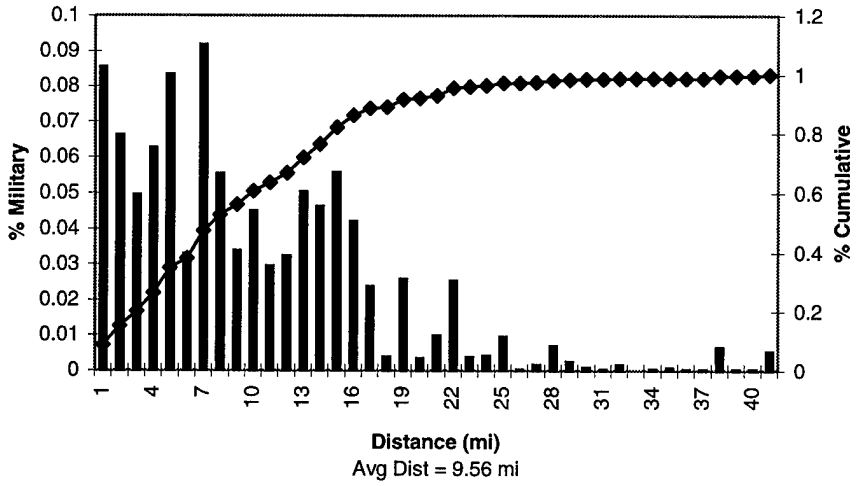
Figure 4: Rank 3 Military Proportion
Sample Size = 1603



Rank group 3 is similar to rank group 2 with 50% of its military families residing within

seven miles of the base. The cumulative graph shows even more of a spread distribution than rank group 2, but it appears that the cumulative graph flattens sooner than the two previous rank groups.

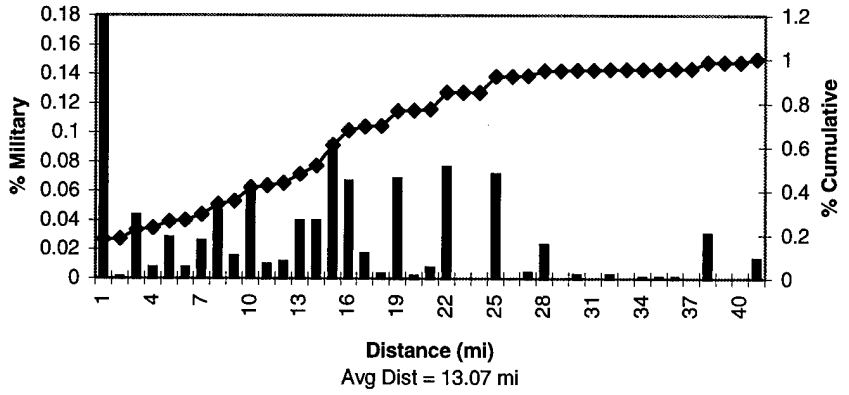
Figure 5: Rank 4 Military Proportion
Sample Size = 877



Rank group 4 reaches its 50th percentile in mile eight, which is greater than the overall average. The cumulative graph rises more gradually than all the others and the distribution appears to be the most spread out.

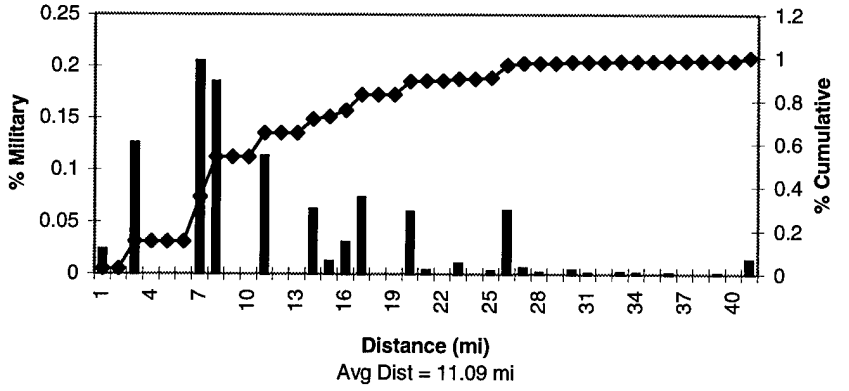
The individual base proportions provide further insight.

Figure 6: Andrews AFB Military Proportion
Sample Size = 499



Andrews AFB is an Air Mobility Command (AMC) base located 11 miles southeast of Washington, DC. It has a total population of 2,069,836 within 40 miles of the base that sits on 7,550 acres. There are 5,990 active duty members, 8,000 family members, 2,093 civilians, 718 guard, and 1,619 reservists. Andrews has a total of 1,019 military within the sample, of which 499 are renters.

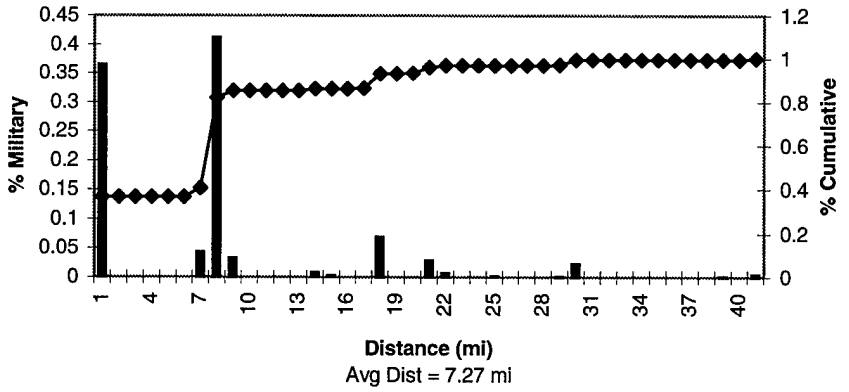
Figure 7: Pope AFB Military Proportion
Sample Size = 660



Pope AFB is an Air Combat Command (ACC) base located 12 miles north-northwest of

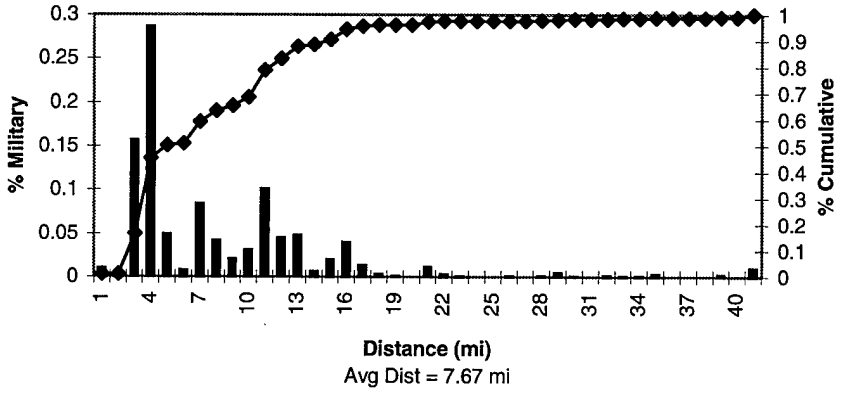
Fayetteville, NC. It has a total population of 672,895 within 40 miles of the base that sits on 1,750 acres. There are 4,800 active duty members and 350 civilians. Pope has a total of 1,538 military within the sample, of which 660 are renters.

Figure 8: Moody AFB Military Proportion
Sample Size = 796



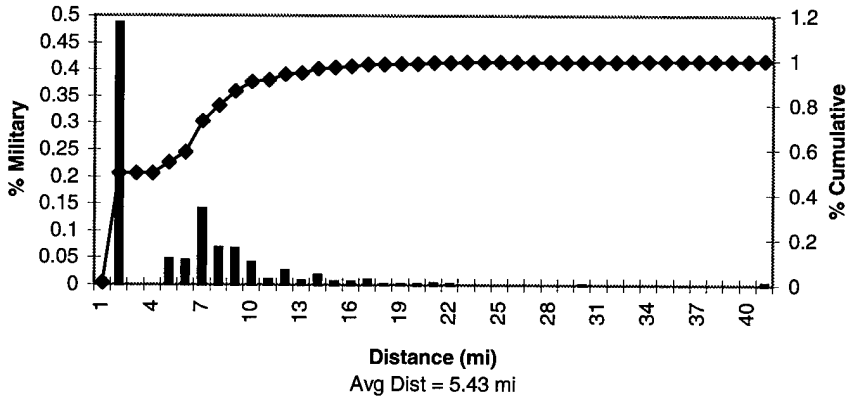
Moody AFB is an ACC base located 10 miles north-northeast of Valdosta, GA. It has a total population of 230,005 within 40 miles of the base that sits on 6,050 acres. There are 3,969 active duty members, 5688 family members, and 698 civilians. Moody has a total of 1,270 military within the sample, of which 796 are renters.

Figure 9: WPAFB Military Proportion
Sample Size = 748



Wright-Patterson AFB is an Air Force Materiel Command (AFMC) base located 10 miles east-northeast of Dayton, OH. It has a total population of 1,521,290 within 40 miles of the base that sits on 8,145 acres. There are 7,100 active duty members, 11,000 family members, 12,600 civilians, and 1,900 reservists. WPAFB has a total of 1,827 military within the sample, of which 748 are renters.

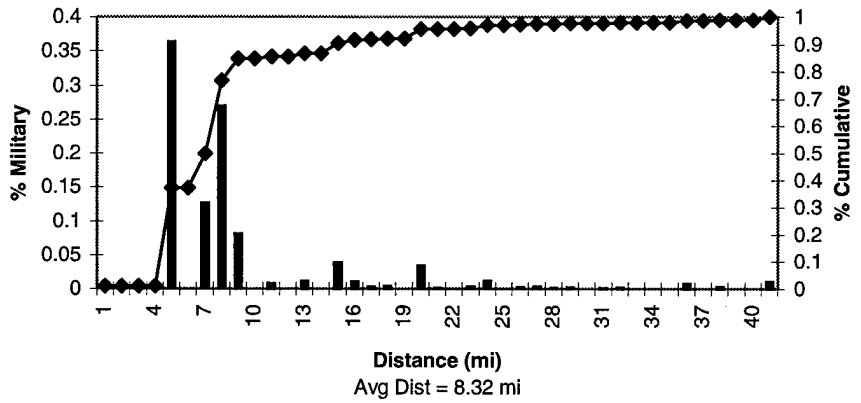
Figure 10: Offutt AFB Military Proportion
Sample Size = 908



Offutt AFB is an ACC base located 8 miles south of Omaha, NB. It has a total

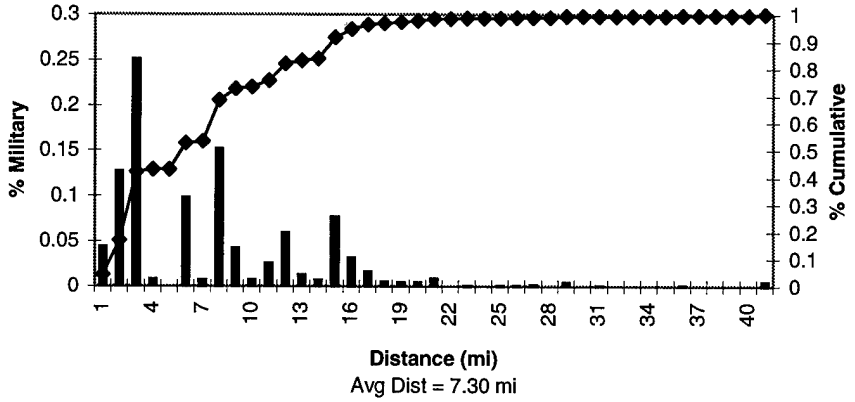
population of 740,098 within 40 miles of the base that sits on 4,044 acres. There are 10,490 active duty members, 22,439 family members, and 3,035 civilians. Offutt has a total of 2,344 military within the sample, of which 908 are renters.

Figure 11: Little Rock AFB Military Proportion
Sample Size = 424



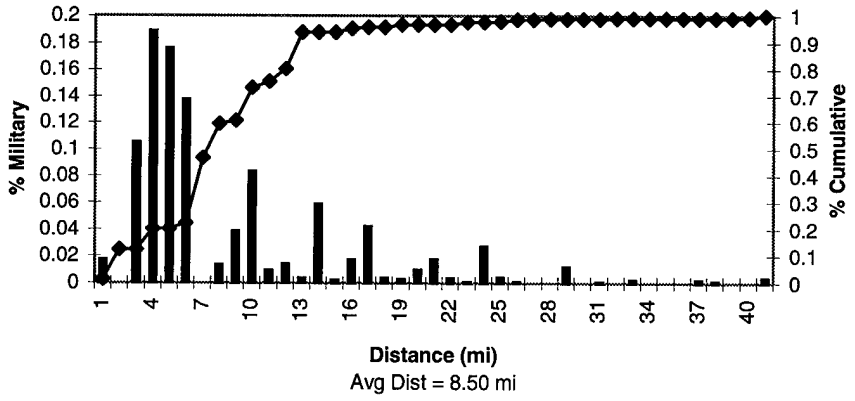
Little Rock AFB is an ACC base located 17 miles northeast of Little Rock, AR. It has a total population of 596,191 within 40 miles of the base that sits on 11,373 acres. There are 4,759 active duty members, 5,558 family members, 1,327 civilians, 131 guard and reservists. Little Rock has a total of 1,198 military within the sample, of which 424 are renters.

Figure 12: Tinker AFB Military Proportion
Sample Size = 1,323



Tinker AFB is an AFMC base located 8 miles southeast of Oklahoma City, OK. It has a total population of 997,775 within 40 miles of the base that sits on 5,000 acres. There are 7,765 active duty members and 13,375 civilians. Tinker has a total of 2,772 military within the sample, of which 1,323 are renters.

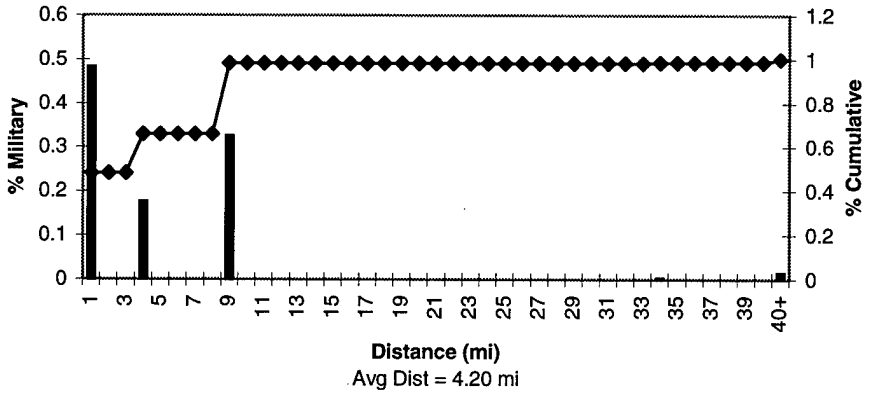
Figure 13: Randolph AFB Military Proportion
Sample Size = 423



Randolph AFB is an Air Education and Training Command (AETC) base located in San Antonio, TX. It has a total population of 1,417,731 within 40 miles of the base that sits

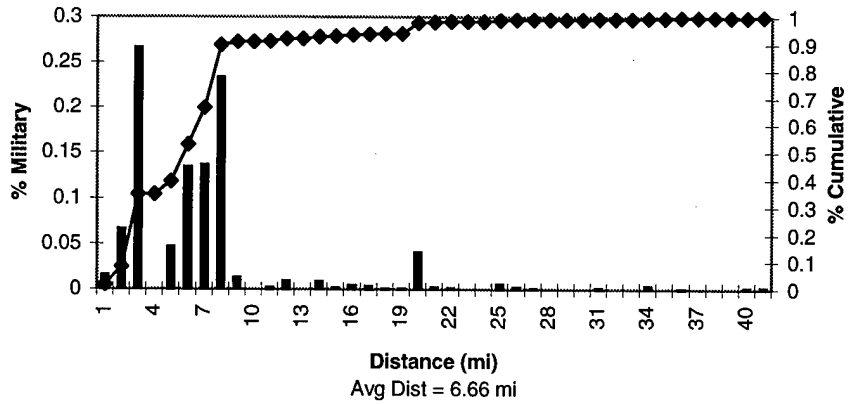
on 5,011 acres. There are 5,237 active duty members, 9,960 family members, and 5,912 civilians. Randolph has a total of 1,387 military within the sample, of which 423 are renters.

Figure 14: F.E. Warren AFB Military Proportion
Sample Size = 474



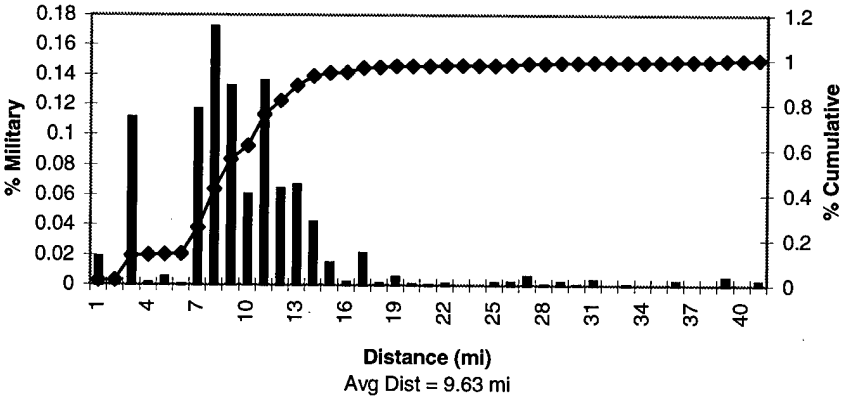
Francis E. Warren AFB is an Air Force Special Project Command (AFSPC) base located in Cheyenne, WY. It has a total population of 114,036 within 40 miles of the base that sits on 5,866 acres. There are 3,441 active duty members, 3,524 family members, and 690 civilians. F.E. Warren has a total of 1,116 military within the sample, of which 474 are renters.

Figure 15: Hill AFB Military Proportion
Sample Size = 564



Hill AFB is an AFMC base located 8 miles south of Ogden, UT. It has a total population of 1,083,377 within 40 miles of the base that sits on 6,698 acres. There are 4,700 active duty members and 9,800 civilians. Hill has a total of 1,446 military within the sample, of which 564 are renters.

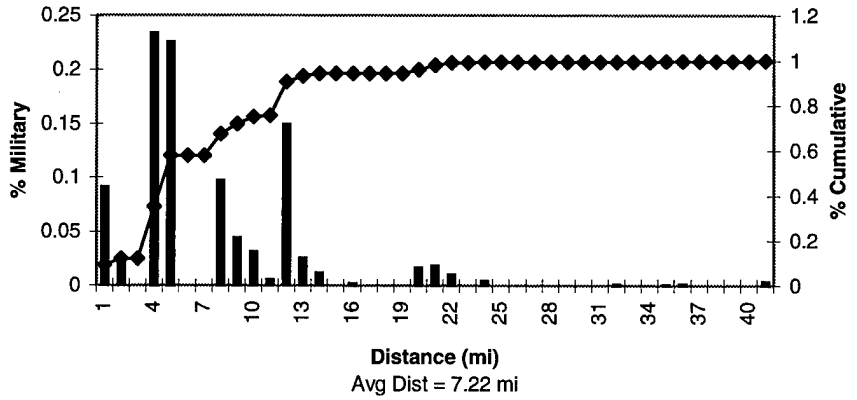
Figure 16: Luke AFB Military Proportion
Sample Size = 1,163



Luke AFB is an AETC base located 20 miles west-northwest of downtown Phoenix in

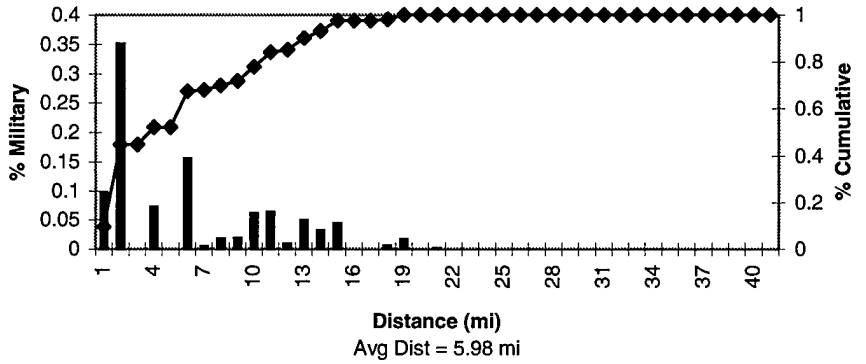
AZ. It has a total population of 2,069,836 within 40 miles of the base that sits on 4,197 acres. There are 5,790 active duty members, 12,352 family members, 1,030 civilians, and 1,000 reservists. Luke has a total of 2,465 military within the sample, of which 1,163 are renters.

Figure 17: Davis-Monthan AFB Military Proportion
Sample Size = 731



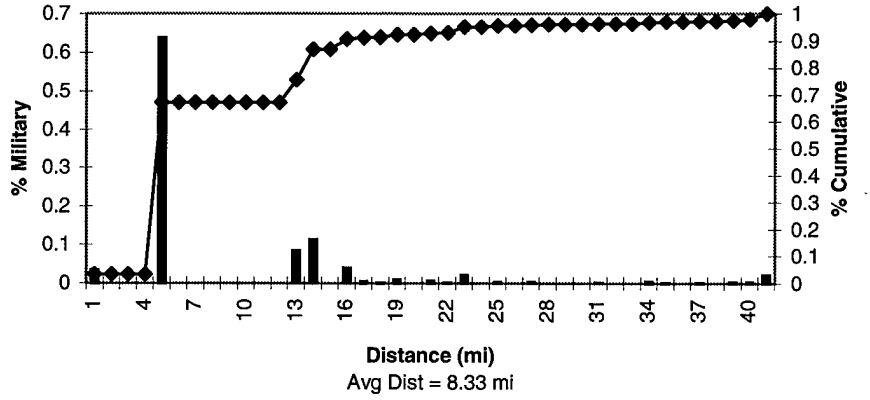
Davis-Monthan AFB is an ACC base located in Tucson Phoenix, AZ. It has a total population of 669,843 within 40 miles of the base that sits on 11,000 acres. There are 5,000 active duty members, 9,000 family members, 800 civilians, 100 guard, and 300 reservists. Davis-Monthan has a total of 1,520 military within the sample, of which 731 are renters.

Figure 18: Nellis AFB Military Proportion
Sample Size = 688



Nellis AFB is an ACC base located 8 miles northeast of Las Vegas, NV. It has a total population of 729,170 within 40 miles of the base that sits on a 3.5 million-acre restricted area. There are 6,432 active duty members, 13,620 family members, and 2,600 civilians. Nellis has a total of 1,669 military within the sample, of which 688 are renters.

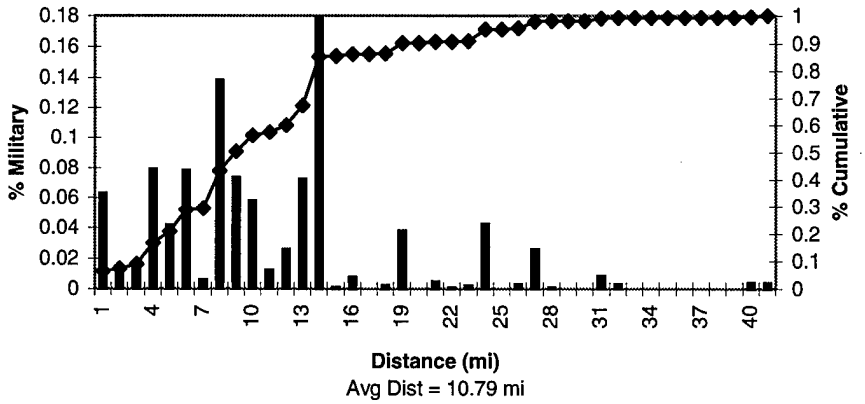
Figure 19: Travis AFB Military Proportion
Sample Size = 1,076



Travis AFB is an AMC base located adjacent to Fairfield, CA. It has a total population of 3,213,403 within 40 miles of the base that sits on 7,580 acres. There are 8,482 active duty

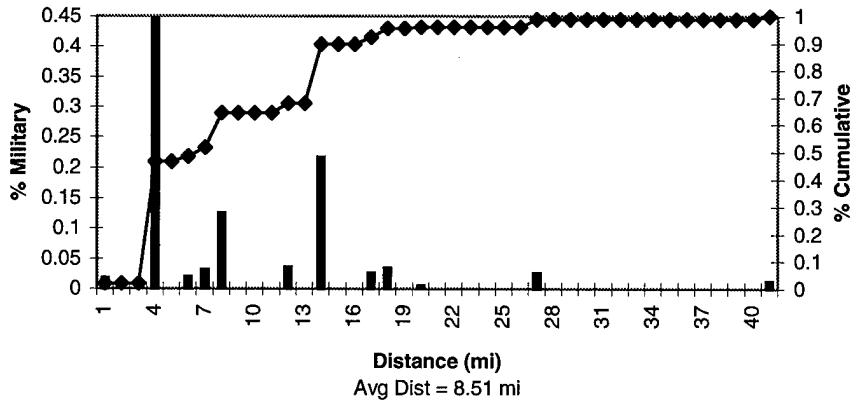
members, 9,040 family members, 1,888 civilians, and 4,317 reservists. Travis has a total of 1,811 military within the sample, of which 1,076 are renters.

Figure 20: McChord AFB Military Proportion
Sample Size = 537



McChord AFB is an AMC base located 8 miles south of Tacoma, WA. It has a total population of 2,076,430 within 40 miles of the base that sits on 4,616 acres. There are 3,748 active duty members, 5,215 family members, 1,970 civilians, and 2,557 guard and 1,619 reservists. McChord has a total of 984 military within the sample, of which 537 are renters.

Figure 21: Elmendorf AFB Military Proportion
Sample Size = 759



Elmendorf AFB is an Pacific Air Combat Air Force (PACAF) base located in Anchorage, AK. It has a total population of 262,180 within 40 miles of the base that sits on 13,130 acres. There are 6,588 active duty members, 9,317 family members, and 1,029 civilians. Elmendorf has a total of 1,462 military within the sample, of which 759 are renters.

No two bases are exactly alike, but some similarities can be seen. Bases near a large metropolis (like Andrews and McChord) seem to have a more distributed proportion (average distances of 13.07 miles and 10.79 miles respectively). On the other end of the spectrum, bases like F.E. Warren and Moody appear to be much more concentrated (with average distances of 4.20 miles and 7.27 miles respectively). Table 3 summarizes the base level information in the sample set.

Table 3: Sample Set Summary

DutyZip	AF Base	Total Pop (w/in 40 miles)	Avg Dist (miles)	# Total Military	# Mil Rent (w/in sample)
20331	Andrews AFB	2,069,836	13.07	5,990	499
28308	Pope	672,895	11.09	4,800	660
31699	Moody	230,005	7.27	3,969	796
45433	WPAFB	1,521,290	7.67	7,100	748
68113	Offutt	740,098	5.43	10,490	908
72099	Little Rock	596,191	8.32	4,759	424
73145	Tinker	997,775	7.30	7,765	1,323
78150	Randolph	1,417,731	8.50	5,237	423
82005	FE Warren	114,036	4.20	3,441	474
84056	Hill	1,083,377	6.66	4,700	564
85309	Luke	2,069,836	9.63	5,790	1,163
85707	Davis-Mothan	669,843	7.22	5,000	731
89191	Nellis	729,170	5.98	6,432	688
94535	Travis	3,213,403	8.33	8,482	1,076
98438	McChord	2,076,430	10.79	3,748	537
99506	Elmendorf	262,180	8.51	6,588	759

This chapter has described the actual locational choices of Air Force renters. Chapter four examines the transportation cost and the implications of those choices.

IV. Housing Allowances and Transportation Costs

Housing Location and Commuting Cost

Military housing allowances only consider explicit housing costs and ignore transportation costs. However, costs per "unit" of housing tend to be less as the distance from the metropolitan area increases. One of the oldest models of analytical urban economics is the "negative cost gradient model" which postulates that the price of land is negatively correlated with the distance from the downtown area. This downtown area has also been referred to as the Central Business District (CBD). As the distance from the CBD increases, the travel cost to and from work also increases. Land is an input for "housing," and the cheaper the land, the cheaper a "unit" of housing. This creates a tradeoff between cheaper housing on a standardized per unit basis and higher travel cost. Referring to the distance graphs in Chapter 3, it appears the proportion of military members decreases with distance from the installation. The important point is that commuting costs influences household location.

Transportation Costs

Travel cost consists of (1) operating cost, such as gasoline, oil, tires, and maintenance, (2) time expended in travel, and (3) the psychic cost due to strain, discomfort, and weariness (Nelson, 1997: 322). 72.8% of the U.S. employed work in the counties of their residence. Of the working public, 96.5% commute to work. Of those that commute to work, 72.8% drive alone and 13.3% carpool (Census CD+ Maps: 1997). The Government does not include travel cost when calculating housing cost because they do not want to inadvertently encourage military members to live further from their duty location in hopes of receiving a larger housing allotment. DoD anticipates if members

were subsidized based upon the distance of their housing from work, more members would live farther away (Foster, 1998). That would negatively affect the military goal of the one-hour response time. DoD pays military members $.31/mile to travel in conjunction with business travel. This is perhaps a lower bound on the true cost because it does not account for the opportunity cost of time nor the psychic strain commuting may bring.

It is interesting to consider the amount and size of transportation costs relative to the Basic Allowance for Housing (BAH). The average military member goes to work five days a week. The military, through its leave policy, allows its members roughly four weeks leave. After allowing for leave, 48 weeks are left for work related travel. So, the average military member travels to and from work 240 days a year. Using a weighted average to calculate the average distance traveled to the duty station in question and multiplying the number of days by $.31/mile, a yearly travel cost is estimated and shown in tables 4 and 5. Tables 4 and 5 also show the explicit travel cost as a percentage of selected pay grades' BAH with and without dependents respectively.

Table 4: Explicit Travel Cost as a % of BAH with Dependents

AFB	Travel Cost ($/yr)	Avg Dist	E4	E9	O3	O6
Andrews	$1,944.70	13.07	21%	14%	14%	11%
Pope	$1,649.56	11.09	27%	19%	19%	15%
Moody	$1,081.05	7.27	19%	13%	13%	10%
WPAFB	$1,141.80	7.67	19%	11%	13%	9%
Offutt	$807.42	5.43	13%	8%	9%	7%
Little Rock	$1,238.07	8.32	24%	14%	15%	11%
Tinker	$1,085.98	7.30	21%	13%	13%	9%
Randolph	$1,265.23	8.50	19%	13%	13%	10%
F.E. Warren	$624.88	4.20	11%	7%	8%	5%
Hill	$990.46	6.66	15%	12%	13%	10%
Luke	$1,432.54	9.63	22%	13%	13%	10%
Davis-Monthan	$1,074.33	7.22	16%	10%	10%	7%
Nellis	$889.82	5.98	11%	7%	7%	6%
Travis	$1,240.22	8.33	15%	10%	11%	9%
McChord	$1,606.19	10.79	24%	15%	16%	12%
Elmendorf	$1,265.81	8.51	13%	8%	8%	7%

In table 4, Andrews AFB has the highest average distance (13.07 miles) and therefore the highest travel cost per year ($1,944.70). Offutt AFB has the lowest average distance (5.43 miles) and the lowest travel cost per year ($807.42). The estimated travel cost shown is also compared to the yearly Basic Allowance for Housing as a percentage. Pope AFB has the highest percentage of the BAH for all rank groups shown (27% for E4; 19% for E9; 19% for O3; and 15% for O6). F.E. Warren AFB and Nellis AFB both have the lowest percentage for E4 and E9 at 11% and 7% respectively. Nellis AFB has the lowest percentage for O3 at 7%. F.E. Warren AFB has the lowest percentage for O6 at 5%. Overall, the lower ranks are relatively more affected by travel cost than the higher ranks, which is expected due to the difference in BAH.

Table 5: Explicit Travel Cost as a % of BAH without Dependents

AFB	Travel Cost ($/yr)	Avg Dist	E4	E9	O3	O6
Andrews	$1,944.70	13.07	26%	18%	16%	13%
Pope	$1,649.56	11.09	36%	25%	23%	17%
Moody	$1,081.05	7.27	26%	16%	15%	11%
WPAFB	$1,141.80	7.67	26%	15%	15%	11%
Offutt	$807.42	5.43	18%	10%	10%	8%
Little Rock	$1,238.07	8.32	29%	18%	18%	13%
Tinker	$1,085.98	7.30	29%	17%	16%	12%
Randolph	$1,265.23	8.50	27%	16%	15%	12%
F.E. Warren	$624.88	4.20	14%	9%	9%	6%
Hill	$990.46	6.66	20%	12%	13%	10%
Luke	$1,432.54	9.63	27%	17%	15%	12%
Davis-Monthan	$1,074.33	7.22	22%	13%	12%	9%
Nellis	$889.82	5.98	15%	9%	9%	7%
Travis	$1,240.22	8.33	21%	14%	13%	11%
McChord	$1,606.19	10.79	33%	20%	19%	15%
Elmendorf	$1,265.81	8.51	19%	11%	11%	9%

The travel cost and average distances in table 5 are unchanged from table 4, but the percentages are larger across the board. Pope AFB again has the highest percentages in all ranks shown (36% for E4; 25% for E9; 23% for O3; and 17% of O6). F.E. Warren AFB has the lowest percentage for E4 (14%). Both F.E. Warren AFB and Nellis equally have the lowest percentages for E9 and O3 (9% and 9% respectively). F.E. Warren has the lowest percentage of O6 (6%). Again, the lower ranks are relatively more affected by travel cost than the higher ranks. Comparing the two tables, those without dependents are relatively more affected by travel cost.

Having illustrated the importance of distance to the locational choices of Air Force renters, Chapter 5 describes two models of locational choice.

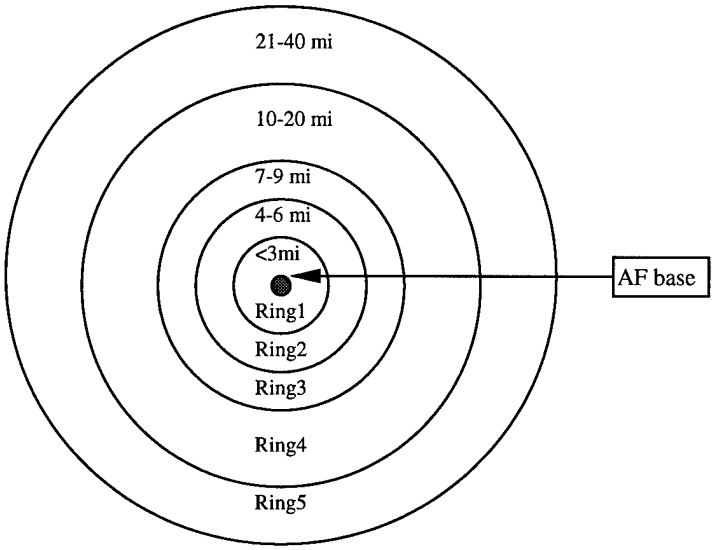
V. Renter Location Choice Models

In order to explain the variations in the distance graphs observed earlier, it is necessary to control for not only distance, but also the location of rental housing stock and its price. Two different models were constructed for this purpose – the ring model and the zip code model.

The Ring Model

The ring model was used as an exploratory model to discover how different variables would affect the proportion of military renters. For this model, the area surrounding each of the sample bases is divided into rings around the duty zip code. The boundary of forty miles ensures the preponderance of military families are captured within it. A total of five rings are created around each base. Ring one contains the area within three miles of the duty zip code. Ring two contains the area between four and six miles. Ring three contains the area between seven and nine miles. Ring four contains the area between ten and twenty miles. Finally, ring five contains the area between twenty-one and forty miles. Figure 22 shows an illustration of the ring model.

Figure 22: Ring Model Diagram



Before proceeding further, the difference between a ring and a disc should be addressed. A ring in the context of this thesis is the area between two fixed points on a radius emanating from the centroid of the zip code in which the duty location exists. For example, ring 2 is the area between four miles and six miles. A disc is the area within a diameter. Again using ring 2, the disc is the area from the center to four miles out. Another way of looking at it is a ring looks like a donut, while a disc resembles a Frisbee. Figure 23 will give a visual representation of the difference between a ring and a disc. Note the shaded portion is the area in question.

Figure 23: Ring versus Disc

(a) Ring (b) Disc

The dependent variable, which is the proportion of military members residing in any given ring, is estimated using multiple linear regression analysis. The average

distance is a constant in each ring. The rental units per ring and per disc, the average rent per ring and disc, and the percent population per ring are found for each rank group at each sample base using census data. These variables are used to construct the independent variables. The variables utilized are the average distance and distance squared; the median rent per ring; the difference between median rent per ring and disc; the percent of rental units per ring and per disc compared to the total rental units within 40 miles; and the percent of population per ring. All independent variables are accepted within the multiple linear regression and no stepwise regression is attempted to explain how much each independent variable contributed to the model. The researcher chose these variables from the available data set to explore their significance to the dependent variable.

The coefficients for distance and distance squared are expected to be negative and positive respectively. This would show that as distance increased, the proportion of military renters in a ring would decrease at a decreasing rate. The coefficient for median rent per ring is expected to be positive, indicating that as median rent per ring increases, the proportion will increase. The expectation is that renters want to live in an area of high median rent, because of the desirable neighborhood characteristics likely to be correlated with more expensive rental housing. The coefficients for the percent of rental units per ring and disc are expected to be positive and negative respectively. This would indicate that renters are more likely to live in a ring with a higher percentage of the total rental units, but less likely to live within a ring the greater the proportion of rental housing which is closer to the base (within the disc). The sign of the coefficient for the percent of population per ring is ambiguous. Greater population density may be undesirable per se,

but it may also correlate with the abundance of desirable characteristics such as more restaurants and shopping areas. The average distance and the median rent are squared to allow for non-linearity in the relationship of those variables to the dependent variable (Devore, 1995:538). Table 6 shows the coefficients, adjusted r-squared values, means, and sample size for each rank group.

Table 6: Ring Model Regression Results
Dependent Variable = Ring Military Proportion

	RANK1	RANK2	RANK3	RANK4	Mean
R-squared Adjusted	0.1904	0.2275	0.2161	0.1464	
Sample Size	75	75	75	75	
Intercept	0.2106	0.2292 **	0.0433	-0.02141	
Distance	0.0021	0.0056	0.0254 **	0.028683 *	11.1
Distance^2	-0.0005	-0.0005	-0.0014 ***	-0.0015 ***	196.05
Rental Units/ Ring	0.0220	0.7660	-1.1833	-2.30259	0.0274
Rental Units/ Disc	-1.8541	-1.9933	-1.4090	-1.34534	0.0181
Med Rent/Ring	0.0001	5.8E-05	0.0002	0.000378	419.17
Med Rent Difference/Disc	0.0002	0.0006 *	-6.6E-05	-1.4E-05	7.9524
% Population/Ring	0.2089	-0.0107	0.5062	0.63951	0.2004
Significant @ 1% Level	***				
Significant @ 5% Level	**				
Significant @ 10% Level	*				

The distance variables are only significant in the officer rank groups. The median rent per disc for rank group 2 is the only other significant variable among the rank groups. The adjusted r-squared values are relatively low indicating that the independent variables used do not explain much of the variance. Given five rings and sixteen bases, there are only 75 observations total per rank group. If there were more observations, the model might yield better results. Another possible limitation is that there may be substantial heterogeneity within the rings.

The Zip Code Model

The Zip Code model creates an observation for each zip code in which at least one military member resides for all sixteen bases. The sample has 918 observations. The number of residential zip codes around any given base varied because the number of zip codes tends to be related to population density. The independent variables used in the model are distance and distance squared; the median rent and median rent squared per zip code; the percent of rental units within a zip code compared to all of those within 40 miles; the products of the percent of rental units with distance and distance squared; the percent of total population located in a rural area per zip code; and the per capita income per zip code.

Certain restrictions were placed on the database. The maximum distance allowed in the study is 40 miles away from the installation (the 0.7% of military renters who lived further than 40 miles were omitted). Secondly, information for a given rank group and a given locality was only included when there were at least 150 members on which to base the zip code proportions. In the regressions, the database was weighted by the number of observations within the rank groups for each locality. This gave more weight to proportions based upon larger samples.

With regard to the independent variables used in the analysis, distance is expected to have a negative sign indicating that the dependent variable (the proportion) is negatively related to distance. Median rent is expected to be positively related. Median rent describes the distribution of rental prices within a zip code. Plausibly, everything else the same, military renters would prefer to rent a low rent unit in an area of high

priced rentals rather than in an area of low priced rentals. However, as the value of the median rent increases, the number of units affordable to military members decreases; this implies a negative sign for the median rent squared variable. The percent of rental units per zip code is expected to have a positive coefficient. As the percentage of rental units within a zip code increases, the proportion of military members residing in that zip code is expected to also increase, because they will have more units to choose from. Assuming that people tend to prefer green space and scenic settings, a positive coefficient is expected for the percentage of total population in a rural area per zip code. The expected sign of the per capita income variable is ambiguous. The coefficient may be positive because an increasing per capita income may indicate better schools within a zip code. However the coefficient may be negative because higher per capita income may indicate more city and local taxes. The product of the percentage of rental units and distance is used to test the proposition that the farther a zip code is from the duty zip code, the less important the rental units within that zip code are to military renters. Therefore, the proportion of military renters living in that zip code will also be smaller. A negative coefficient and positive coefficient for this variable and its square are expected. As distance increases the importance of the availability of rental units in a zip code decreases at a decreasing rate. More generally, the squared terms for distance, median rent, and the product of percent of rental units and distance are included among the explanatory variables in order to allow for non-linearity within the model (Devore, 1995:538).

Data Grouping

If the relationship of the independent variables to the proportion of military renters living within a zip code is the same for all rank groups, then the observations of

military families within the sample can be grouped together in one model. This hypothesis is tested using an F-Test based upon the reduction in the sum of squared errors obtained by using an expanded model, which allows the impact of the intercept and all the explanatory variables to vary, by rank group. The F test statistic was insignificant at the 5% level indicating that pooling the rank groups is acceptable.

Table 7 shows the adjusted r-square and the parameter estimates of the regression based upon the total sample.

Table 7: Zip Code Total Sample Regression Results
Dependent Variable = Zip Code Military Proportion

R-squared Adjusted	0.2637	
Sample Size	918	
	Coefficient	Mean
Intercept	0.0063	
Distance	-0.0116 ***	12.6562
Distance^2	0.0002 ***	316.2243
Median Rent	0.0007 ***	475.0958
Median Rent^2	-4.19E-07 ***	253610.22
% Rental Unit/Zip Code	2.4849 ***	0.0222
Dist * % Rental Unit/zip	-0.2412 ***	0.2813
(Dist * % Rental Unit/Zip)^2	0.0054 ***	5.2972
% Rural Population / Zip	0.0445 ***	0.2130
Income per Capita	-3.63E-6 ***	16979.64
Significant @ 1% Lvl	***	
Significant @ 5% Lvl	**	
Significant @ 10% Lvl	*	

As shown in Table 7, each of the independent variables is significant at the 1% level. The adjusted r-squared value is 0.2637.

The negative and positive sign on the distance and distance squared coefficients respectively show that with increasing distance, the proportion of military renters

decreases at a decreasing rate. The positive and negative sign on the median rent and median rent squared coefficients respectively imply that with increasing median zip code rent the proportion increases at a decreasing rate to a point and then decreases at an increasing rate. For military living within a zip code, the median rent which maximizes the dependent variable for this model is $1,551.31. This is the maximum median rent before the proportion of military members begins to decrease, holding all other independent variables at their means. The percent of total rental units within a zip code has a positive coefficient. The product of distance and percent rental units and its squared term have a negative and positive sign respectively. This supports the proposition that the farther a zip code is from the duty zip code, the less important is the percentage of total rental units contained in that zip code. The percent of rural population per zip code has a positive coefficient as expected. The per capita income has a negative coefficient indicating that as income per capita increases the proportion of military members tends to decrease.

Figure 24: Distance vs Proportion Relationship

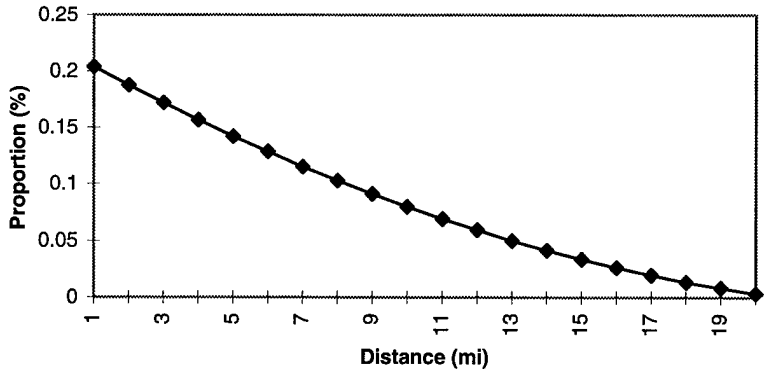


Figure 24 shows the estimated decrease in proportion of military renters as distance increases when the values of the other independent variables are held to their means. At 20 miles, the proportion approaches zero and this defines the estimated boundary of the rental housing market relevant to military renters in this special case.

The above zip code model equation is based upon a sample which has 33.3% in rank group 1, 50.8% in rank group 2, 7.3% in rank group 3, and 8.5% in rank group 4. As mentioned previously, the F-Test shows that the pooling rank groups are acceptable. However, rank distribution could be significantly different at some localities—e.g. 64% of Andrews AFB falls into rank group 4, while no other base has more than 9% that fall into that rank group. So, more accuracy in estimating the proportions at a given locality can potentially be obtained by relying upon separate models for the rank groups.[3] Table 8 shows the means of the separate rank data sets.

Table 8: Rank Group Means

	RANK1	RANK2	RANK3	RANK4
Sample Size	306	466	68	79
Intercept				
Distance	11.7616	13.6267	14.6433	9.5164
Median Rent	445.219	439.0687	476.6324	802.0127
% Rental Unit/Zip Code	0.0287	0.0225	0.0121	0.004
Dist * % Rental Unit	0.3171	0.3122	0.1845	0.044
% Units in Rural Zip	0.1757	0.2732	0.1453	0.0607
% Income	15922.98	15607.38	17831.78	28433.7

Rank group 3 has the highest average distance (14.64 miles) and rank group 4 has the lowest (9.52 miles). Rank group 4 has the highest median rent ($802.01) and rank group 1 has the lowest ($270.27).[4] Rank group 1 lives in zip codes for which rental

[3] The data does not contain potentially relevant information such as the number and age of dependents, spouse labor force status, and family income. The absence of these variables in the regression equation describing zip code averages of these characteristics creates an "omitted variable" problem. As a result, separating the data set into rank groups of similar ages and life stage helps to reduce the impact of this problem.

[4] Andrews AFB alone contains over 36% of the military members in rank group 4 (319 of the 877 observations).

housing is the most concentrated (2.8%). Rank group 2 lives in zip codes with the highest concentration of rural population (27.3%). Officers live in zip codes with higher per capita incomes than enlisted zip codes.

Table 9: Zip Code Rank Group Regression Results
Dependent Variable = Zip Code Military Proportion

	RANK1	RANK2	RANK3	RANK4
R-squared Adjusted	0.4235	0.2871	0.4524	0.1705
Sample Size	305	465	67	78
Intercept	-0.0592	0.0431	-0.2447	0.0689
Distance	-0.0102 ***	-0.0171 ***	0.0031	-0.0033
Distance^2	0.0002 ***	0.0003 ***	-0.0002	0.0001
Median Rent	0.0007 ***	0.0009 ***	0.0010 **	-0.0002
Median Rent^2	-5.6E-07 ***	-6.2E-07 ***	-5.8E-07	3.1E-07
% Rental Unit/Zip Code	2.2151 ***	2.7284 ***	10.9798 ***	4.6003
Dist * % Rental Unit	-0.2341 ***	-0.2876 ***	-1.3258 ***	-0.2119
(Dist * % Rental Unit)^2	0.0064 ***	0.0064 ***	0.0319 ***	0.0137
% Units in Rural Zip	0.0485 ***	0.0478 *	0.0048	0.0067
Per Capita Income	-1.3E-06	-4.3E-06 **	-2.5E-06	-1.8E-06 **
Significant @ 1% Lvl	***			
Significant @ 5% Lvl	**			
Significant @ 10% Lvl	*			

Table 9 shows the results of the separate rank group regression models. The r-squared values for rank groups 1 and 3 show a noticeable increase compared to the grouped model (0.4235 and 0.4524 respectively versus 0.2637). Rank group 2 is slightly above the grouped r-squared value (0.2871) and rank group 4 falls below the grouped value (0.1705). Rank group 2 has the highest sample size (465) and rank group 3 has the lowest (67).

Distance and distance squared are significant only for rank groups 1 and 2 (at the

1% level). Median rent is significant for rank groups 1 and 2 at the 1% level, and rank group 3 at the 5% level. Median rent squared is significant for rank groups 1 and 2 at the 1% level. The proportion maximizing median rent for rank groups 1 and 2 are $1,250.00 and $1,612.90 respectively. Rank groups 1 and 2 show a positive coefficient for the percentage of rental units per zip code (significant at the 1% level). Rank groups 1, 2, and 3 exhibit a negative coefficient for the product of distance and percentage of rental units (significant at the 1% level). All rank groups show a positive coefficient for the percent of rural population in a zip code. This coefficient is significant at the 1% level for rank group 1 and at the 10% level for rank group 2. Finally, rank groups 2 and 4 show a negative coefficient for per capita income. This variable is significant at the 5% level for both rank groups 2 and 4. It appears that separating the sample into four rank groups substantially improves the estimations for junior enlisted and junior officers (rank groups 1 and 3).

VI. Conclusions and Recommendations

Conclusions

This thesis has developed evidence that the approach used in the Housing Market Analysis Guidance is flawed because the assumption of constant proportionality within the HMA is not supported by actual data on the locational choices of military renters. All housing within the military housing area should not be equally weighted. The distance a rental unit is from the duty location plays a major role in the location choices of military renters. Also, this research indicates that transportation cost varies substantially by location. The research shows that uncompensated travel costs vary greatly by base and that these costs fall particularly hard on the unmarried and/or the lower ranking when considered as a percentage of the location specific Basic Allowance for Housing.

This research explores modeling the proportion of military renters using a multiple linear regression model. The study shows that distance must be accounted for when estimating the proportion of military renters.[5] With regard to commuting costs, a suggestion is for DoD to increase the BAH in areas where the average commuting distance substantially exceeds the national average. If this suggestion is followed, the increase should be issued to all off-base renters to avoid creating an incentive to live farther from the duty location. The locational choices of owners should also be examined and compensated for travel expenses similarly to renters.

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[5] Using the Model to Weight Rental Units. A zip code model can be used to weight rental housing around an installation by the likelihood military members will actually choose to live there. First, set all variables to their zip code values and then multiply the by the coefficients of each variable. These products summed along with the intercept yield an estimate of the proportion of military renters who will choose to live in that zip code.

Multiply the proportion by the number of military renters within 40 miles of the duty location; this will yield the number of military renters expected to live in each zip code. The ratio of military renters to civilian renters can be multiplied by the number of suitable rental units estimated for each zip code to obtain an estimated number of suitable units available to military renters. The total supply of suitable rental units is the sum of the weighted, suitable rental units for all zip codes. The information needed to accomplish the weighting can be obtained through a combination of census and DoD data.

Recommendations

The exploratory analysis in this thesis needs further refinement. The hetereoscedasticity introduced by the use of the proportional data for the dependent variable may possibly be corrected by using a probit or logit transformation (Devore, 1995: 531). Bias is inherit in the data because the only zip codes used were the 1990 zip codes found in CensusCD+ Maps. Using the missing zip codes created in 1996 will add valuable data points to the data set. Also, zip codes at the boundaries of the commuting area that did not have any military members living there should be included. If available, more precision could be obtained by using addresses of military renters when calculating distance instead of relying upon the centroid of their local zip code. The study could be expanded to include more Air Force bases. Important information was not available. The present research is limited by the fact that zip code boundaries do not reflect political boundaries. Zip codes are based on population while political boundaries correlate with important locational considerations such as school districts and city income taxes. Ideally, factors such as marital status, location of spousal employment, and the number and age of dependents should be incorporated into the analysis. Finally, due to the fact that the issues investigated in this thesis are not unique to the Air Force and that DoD housing policies and allowances are standardized between services, the analysis should be expanded to include a representative sample of Navy, Army, Marines, and Coast Guard personnel.

Appendix A: Total Sample Military Proportion Data

Distance (miles)	% Military	Cumulative
1	0.083704	0.0837038
2	0.084178	0.1678813
3	0.076088	0.243969
4	0.083376	0.3273448
5	0.09449	0.421835
6	0.04351	0.4653449
7	0.059872	0.5252166
8	0.126777	0.6519931
9	0.053021	0.705014
10	0.026966	0.73198
11	0.035384	0.7673637
12	0.031594	0.7989576
13	0.026857	0.8258142
14	0.044603	0.8704174
15	0.021136	0.8915529
16	0.016034	0.9075867
17	0.014321	0.9219078
18	0.009001	0.9309086
19	0.007653	0.9385611
20	0.009584	0.9481449
21	0.007434	0.9555788
22	0.005503	0.9610813
23	0.002405	0.9634864
24	0.003826	0.9673127
25	0.004482	0.9717949
26	0.004227	0.976022
27	0.004009	0.9800305
28	0.001348	0.9813788
29	0.001822	0.9832008
30	0.002223	0.9854237
31	0.001093	0.9865169
32	0.000583	0.9870999
33	0.000364	0.9874644
34	0.000802	0.988266
35	0.000437	0.9887033
36	0.000911	0.9896143
37	0.000255	0.9898694
38	0.001603	0.9914728
39	0.000911	0.9923838
40	0.000437	0.9928211
40+	0.007179	0.9999999

Appendix B: Rank Group Military Proportion Data

Distance	RANK 1		RANK 2		RANK 3		RANK 4	
(miles)	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative
1	0.082453	0.082453	0.082482	0.082482	0.088646	0.088646	0.08547	0.08547
2	0.092547	0.175	0.086366	0.168848	0.077216	0.165862	0.06616	0.15163
3	0.123758	0.298758	0.06508	0.233928	0.05842	0.224283	0.049383	0.201013
4	0.092391	0.391149	0.083202	0.317129	0.085852	0.310135	0.062678	0.263691
5	0.099534	0.490683	0.096721	0.41385	0.087376	0.397511	0.083254	0.346945
6	0.034783	0.525466	0.050482	0.464332	0.041656	0.439167	0.032922	0.379867
7	0.049224	0.57469	0.055228	0.51956	0.068072	0.507239	0.091801	0.471668
8	0.135404	0.710093	0.146052	0.665612	0.101854	0.609093	0.055397	0.527066
9	0.059006	0.769099	0.050482	0.716094	0.067564	0.676657	0.033872	0.560937
10	0.02236	0.79146	0.023803	0.739897	0.031242	0.7079	0.044951	0.605888
11	0.051708	0.843168	0.028405	0.768302	0.0381	0.746	0.02944	0.635328
12	0.023758	0.866926	0.034518	0.802819	0.033528	0.779528	0.032289	0.667616
13	0.015062	0.881988	0.022221	0.82504	0.043688	0.823216	0.050332	0.717949
14	0.028571	0.910559	0.050841	0.875881	0.047498	0.870714	0.046217	0.764166
15	0.008851	0.91941	0.015245	0.891126	0.03429	0.905004	0.055714	0.81988
16	0.011801	0.931211	0.010427	0.901553	0.021844	0.926848	0.042102	0.861982
17	0.008696	0.939907	0.01467	0.916223	0.014732	0.94158	0.023742	0.885723
18	0.010093	0.95	0.011074	0.927298	0.004064	0.945644	0.003799	0.889522
19	0.003571	0.953571	0.005393	0.932691	0.00762	0.953264	0.025958	0.91548
20	0.009938	0.963509	0.011865	0.944557	0.005842	0.959106	0.003482	0.918962
21	0.00559	0.969099	0.008558	0.953114	0.004572	0.963678	0.009813	0.928775
22	0.002329	0.971429	0.00302	0.956134	0.003556	0.967234	0.025325	0.9541
23	0.001553	0.972981	0.00151	0.957644	0.005842	0.973076	0.003799	0.957898
24	0.002174	0.975155	0.005321	0.962966	0.001016	0.974092	0.004115	0.962013
25	0.001708	0.976863	0.004818	0.967784	0.00381	0.977902	0.009497	0.97151
26	0.004814	0.981677	0.00489	0.972674	0.004064	0.981966	0.000317	0.971827
27	0.001708	0.983385	0.006041	0.978715	0.00254	0.984506	0.001583	0.973409
28	0	0.983385	0.000791	0.979506	0.001016	0.985522	0.006964	0.980374
29	0.001553	0.984938	0.002157	0.981663	0.000508	0.98603	0.002532	0.982906
30	0.003571	0.988509	0.002229	0.983892	0.001016	0.987046	0.00095	0.983856
31	0.001553	0.990062	0.001151	0.985043	0.000762	0.987808	0.000317	0.984172
32	0.000155	0.990217	0.000575	0.985618	0.000508	0.988316	0.001583	0.985755
33	0.000155	0.990373	0.00036	0.985978	0.001016	0.989332	0	0.985755
34	0.000621	0.990994	0.000863	0.986841	0.00127	0.990602	0.000317	0.986072
35	0.000155	0.991149	0.00036	0.9872	0.001016	0.991618	0.000633	0.986705
36	0.001087	0.992236	0.001223	0.988423	0	0.991618	0.000317	0.987021
37	0.000155	0.992391	0.000288	0.98871	0.000254	0.991872	0.000317	0.987338
38	0.000155	0.992547	0.001366	0.990077	0.000762	0.992634	0.006648	0.993986
39	0.000155	0.992702	0.001438	0.991515	0.000762	0.993396	0.000317	0.994302
40	0.000466	0.993168	0.00036	0.991874	0.000762	0.994158	0.000317	0.994619
40+	0.006832	1	0.008126	1	0.005842	1	0.005381	1

Appendix C: Military Proportions for Sample Bases

Distance	Andrews		Pope		Moody		WPAFB	
(miles)	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative
1	0.179549	0.179549	0.022872	0.022872	0.364682	0.364682	0.009799	0.009799
2	0.000805	0.180354	0	0.022872	0	0.364682	0	0.009799
3	0.043478	0.223833	0.125794	0.148666	0	0.364682	0.156777	0.166576
4	0.007246	0.231079	0	0.148666	0	0.364682	0.286336	0.452912
5	0.02818	0.259259	0	0.148666	0	0.364682	0.048993	0.501905
6	0.007246	0.266506	0	0.148666	0	0.364682	0.007621	0.509526
7	0.025765	0.292271	0.204574	0.35324	0.042521	0.407204	0.083832	0.593359
8	0.046699	0.33897	0.184879	0.53812	0.411706	0.81891	0.041372	0.634731
9	0.015298	0.354267	0	0.53812	0.032516	0.851426	0.020142	0.654872
10	0.061192	0.415459	0	0.53812	0	0.851426	0.030485	0.685357
11	0.009662	0.425121	0.113088	0.651207	0	0.851426	0.101252	0.786609
12	0.011272	0.436393	0	0.651207	0.0005	0.851926	0.044638	0.831247
13	0.039453	0.475845	0	0.651207	0	0.851926	0.04736	0.878606
14	0.039453	0.515298	0.062262	0.713469	0.007504	0.85943	0.005988	0.884594
15	0.093398	0.608696	0.012071	0.72554	0.002501	0.861931	0.019597	0.904192
16	0.066828	0.675523	0.030496	0.756036	0	0.861931	0.039739	0.94393
17	0.016908	0.692432	0.073062	0.829098	0.0005	0.862431	0.013065	0.956995
18	0.003221	0.695652	0	0.829098	0.069535	0.931966	0.003266	0.960261
19	0.068438	0.76409	0	0.829098	0	0.931966	0.001089	0.96135
20	0.00161	0.7657	0.059721	0.888819	0.0005	0.932466	0	0.96135
21	0.007246	0.772947	0.003812	0.892631	0.028514	0.960981	0.010887	0.972237
22	0.07649	0.849436	0	0.892631	0.007004	0.967984	0.003266	0.975503
23	0	0.849436	0.010165	0.902796	0	0.967984	0.000544	0.976048
24	0	0.849436	0	0.902796	0.0005	0.968485	0	0.976048
25	0.071659	0.921095	0.003177	0.905972	0.001001	0.969485	0	0.976048
26	0	0.921095	0.060991	0.966963	0	0.969485	0.000544	0.976592
27	0.004026	0.925121	0.006353	0.973317	0	0.969485	0	0.976592
28	0.023349	0.94847	0.001906	0.975223	0	0.969485	0.000544	0.977136
29	0	0.94847	0	0.975223	0.001501	0.970986	0.004355	0.981491
30	0.002416	0.950886	0.004447	0.97967	0.023012	0.993997	0.000544	0.982036
31	0	0.950886	0.001271	0.980941	0	0.993997	0	0.982036
32	0.002416	0.953301	0	0.980941	0.0005	0.994498	0.001633	0.983669
33	0	0.953301	0.001906	0.982847	0	0.994498	0.000544	0.984213
34	0.000805	0.954106	0.001271	0.984117	0	0.994498	0.000544	0.984758
35	0.000805	0.954911	0	0.984117	0	0.994498	0.003266	0.988024
36	0.000805	0.955717	0.001271	0.985388	0	0.994498	0	0.988024
37	0	0.955717	0	0.985388	0	0.994498	0	0.988024
38	0.030596	0.986312	0	0.985388	0.0005	0.994998	0	0.988024
39	0	0.986312	0.000635	0.986023	0.001001	0.995998	0.002178	0.990201
40	0	0.986312	0	0.986023	0	0.995998	0	0.990201
40+	0.013688	1	0.013977	1	0.004002	1	0.009799	1

Distance	Offutt		Little Rock		Tinker		Randolph	
(miles)	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative
1	0.009358	0.009358	0.008278	0.008278	0.043403	0.043403	0.017167	0.013475
2	0.486176	0.495534	0	0.008278	0.126736	0.170139	0	0.12512
3	0	0.495534	0	0.008278	0.250694	0.420833	0.10515	0.12512
4	0	0.495534	0	0.008278	0.007639	0.428472	0.188841	0.202117
5	0.047214	0.542748	0.363411	0.371689	0	0.428472	0.175966	0.202117
6	0.044662	0.58741	0	0.371689	0.097569	0.526042	0.137339	0.221848
7	0.140366	0.727775	0.125828	0.497517	0.006944	0.532986	0	0.466314
8	0.068056	0.795832	0.26904	0.766556	0.151736	0.684722	0.013591	0.596246
9	0.066355	0.862186	0.081126	0.847682	0.042014	0.726736	0.038627	0.607315
10	0.040834	0.90302	0	0.847682	0.006944	0.73368	0.082976	0.732435
11	0.009358	0.912378	0.00745	0.855132	0.025347	0.759028	0.009299	0.756978
12	0.025521	0.937899	0	0.855132	0.059375	0.818403	0.014306	0.802214
13	0.006806	0.944704	0.011589	0.866722	0.012847	0.83125	0.003577	0.939846
14	0.017439	0.962144	0	0.866722	0.006944	0.838194	0.058655	0.939846
15	0.00553	0.967673	0.03808	0.904801	0.076736	0.91493	0.002146	0.939846
16	0.00638	0.974054	0.010762	0.915563	0.031597	0.946528	0.017167	0.952358
17	0.008932	0.982986	0.002483	0.918046	0.015972	0.9625	0.042203	0.956689
18	0.001276	0.984262	0.003311	0.921358	0.004861	0.967361	0.003577	0.956689
19	0.001701	0.985964	0	0.921358	0.004167	0.971528	0.002861	0.967276
20	0.000851	0.986814	0.03394	0.955298	0.004514	0.976041	0.010014	0.967276
21	0.003828	0.990642	0.000828	0.956126	0.008333	0.984375	0.017883	0.967276
22	0.002127	0.992769	0	0.956126	0	0.984375	0.003577	0.967276
23	0.000425	0.993195	0.002483	0.958609	0.000694	0.985069	0.000715	0.976901
24	0	0.993195	0.011589	0.970199	0	0.985069	0.027182	0.976901
25	0	0.993195	0	0.970199	0.001042	0.986111	0.004292	0.978826
26	0.000425	0.99362	0.001656	0.971854	0.001042	0.987153	0.000715	0.985082
27	0	0.99362	0.002483	0.974338	0.001389	0.988541	0	0.987006
28	0	0.99362	0.000828	0.975165	0	0.988541	0	0.987969
29	0.000425	0.994045	0.001656	0.976821	0.004514	0.993055	0.01216	0.987969
30	0.000851	0.994896	0	0.976821	0	0.993055	0	0.988931
31	0.000425	0.995321	0.000828	0.977649	0.000694	0.99375	0.000715	0.989413
32	0.000425	0.995747	0.001656	0.979304	0.000347	0.994097	0	0.990375
33	0.000425	0.996172	0	0.979304	0	0.994097	0.002146	0.990375
34	0.000425	0.996597	0	0.979304	0	0.994097	0	0.990375
35	0	0.996597	0	0.979304	0	0.994097	0	0.990375
36	0	0.996597	0.00745	0.986755	0.001042	0.995139	0	0.990375
37	0.000425	0.997023	0	0.986755	0	0.995139	0.002146	0.990856
38	0	0.997023	0.002483	0.989238	0	0.995139	0.001431	0.990856
39	0	0.997023	0	0.989238	0	0.995139	0	0.990856
40	0	0.997023	0	0.989238	0	0.995139	0	0.9923
40+	0.002978	1	0.010762	1	0.004861	1	0.003577	1

Distance	FE Warren		Hill		Luke		Davis-Monthan	
(miles)	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative
1	0.482578	0.482578	0.01584	0.01584	0.018556	0.018556	0.091453	0.091453
2	0	0.482578	0.066116	0.081956	0	0.018556	0.026898	0.11835
3	0	0.482578	0.266529	0.348485	0.111335	0.129891	0	0.11835
4	0.175958	0.658537	0	0.348485	0.00121	0.131101	0.233712	0.352062
5	0	0.658537	0.046143	0.394628	0.005244	0.136345	0.225344	0.577406
6	0	0.658537	0.133609	0.528237	0.000403	0.136749	0	0.577406
7	0	0.658537	0.135675	0.663912	0.116579	0.253328	0	0.577406
8	0	0.658537	0.232782	0.896694	0.171844	0.425172	0.09743	0.674836
9	0.324913	0.98345	0.012397	0.909091	0.132311	0.557483	0.044232	0.719068
10	0	0.98345	0	0.909091	0.060508	0.617991	0.031082	0.75015
11	0	0.98345	0.002066	0.911157	0.135539	0.75353	0.00538	0.755529
12	0	0.98345	0.008953	0.92011	0.064139	0.817669	0.149432	0.904961
13	0	0.98345	0	0.92011	0.066963	0.884631	0.025105	0.930066
14	0	0.98345	0.008265	0.928375	0.041952	0.926583	0.011955	0.942021
15	0	0.98345	0.001377	0.929752	0.014925	0.941509	0	0.942021
16	0	0.98345	0.004132	0.933884	0.002017	0.943526	0.001793	0.943814
17	0	0.98345	0.003444	0.937328	0.020976	0.964502	0	0.943814
18	0	0.98345	0.000689	0.938017	0.00121	0.965712	0	0.943814
19	0	0.98345	0.000689	0.938705	0.005647	0.97136	0	0.943814
20	0	0.98345	0.040634	0.979339	0.000807	0.972166	0.016736	0.96055
21	0	0.98345	0.002066	0.981405	0.000403	0.97257	0.01853	0.97908
22	0	0.98345	0.001377	0.982782	0.00121	0.97378	0.010161	0.989241
23	0	0.98345	0	0.982782	0	0.97378	0	0.989241
24	0	0.98345	0	0.982782	0	0.97378	0.004184	0.993425
25	0	0.98345	0.00551	0.988292	0.001614	0.975394	0	0.993425
26	0	0.98345	0.002066	0.990358	0.002017	0.97741	0	0.993425
27	0	0.98345	0.000689	0.991047	0.006051	0.983461	0	0.993425
28	0	0.98345	0	0.991047	0.000403	0.983865	0	0.993425
29	0	0.98345	0	0.991047	0.002017	0.985882	0	0.993425
30	0	0.98345	0	0.991047	0.000403	0.986285	0	0.993425
31	0	0.98345	0.001377	0.992424	0.003227	0.989512	0	0.993425
32	0	0.98345	0	0.992424	0	0.989512	0.001196	0.994621
33	0	0.98345	0	0.992424	0.000403	0.989915	0	0.994621
34	0.002613	0.986063	0.003444	0.995868	0	0.989915	0	0.994621
35	0	0.986063	0	0.995868	0	0.989915	0.000598	0.995218
36	0	0.986063	0.000689	0.996556	0.00242	0.992336	0.001196	0.996414
37	0	0.986063	0	0.996556	0	0.992336	0	0.996414
38	0	0.986063	0	0.996556	0	0.992336	0	0.996414
39	0	0.986063	0	0.996556	0.005244	0.99758	0	0.996414
40	0	0.986063	0.001377	0.997934	0	0.99758	0	0.996414
40+	0.013937	1	0.002066	1	0.00242	1	0.003586	1

Distance	Nellis		Travis		McChord		Elmendorf	
(miles)	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative	% Military	Cumulative
1	0.096862	0.096862	0.033751	0.033751	0.062857	0.062857	0.018418	0.018418
2	0.351191	0.448052	0	0.033751	0.010476	0.073333	0	0.018418
3	0	0.448052	0	0.033751	0.015238	0.088571	0	0.018418
4	0.072511	0.520563	0	0.033751	0.079048	0.167619	0.446112	0.464529
5	0	0.520563	0.637452	0.671203	0.041905	0.209524	0	0.464529
6	0.155303	0.675866	0	0.671203	0.078095	0.287619	0.019782	0.484311
7	0.00487	0.680736	0	0.671203	0.005714	0.293333	0.03206	0.516371
8	0.017857	0.698593	0	0.671203	0.138095	0.431429	0.126194	0.642565
9	0.018939	0.717532	0	0.671203	0.073333	0.504762	0	0.642565
10	0.061147	0.77868	0	0.671203	0.058095	0.562857	0	0.642565
11	0.063312	0.841991	0	0.671203	0.012381	0.575238	0	0.642565
12	0.009199	0.85119	0	0.671203	0.025714	0.600952	0.036153	0.678718
13	0.049242	0.900433	0.083832	0.755035	0.072381	0.673333	0	0.678718
14	0.031926	0.932359	0.112684	0.867719	0.179048	0.852381	0.216917	0.895634
15	0.043831	0.97619	0	0.867719	0.000952	0.853333	0	0.895634
16	0	0.97619	0.03865	0.906369	0.007619	0.860952	0	0.895634
17	0	0.97619	0.004355	0.910724	0	0.860952	0.025921	0.921555
18	0.005952	0.982143	0.002178	0.912902	0.001905	0.862857	0.034789	0.956344
19	0.016775	0.998918	0.009254	0.922156	0.038095	0.900952	0	0.956344
20	0	0.998918	0	0.922156	0	0.900952	0.004775	0.961119
21	0.001082	1	0.005988	0.928144	0.004762	0.905714	0	0.961119
22	0	1	0.001633	0.929777	0.000952	0.906667	0	0.961119
23	0	1	0.021775	0.951551	0.001905	0.908571	0	0.961119
24	0	1	0	0.951551	0.042857	0.951428	0	0.961119
25	0	1	0.003266	0.954818	0	0.951428	0	0.961119
26	0	1	0.000544	0.955362	0.002857	0.954286	0	0.961119
27	0	1	0.003266	0.958628	0.025714	0.98	0.026603	0.987722
28	0	1	0.000544	0.959173	0.000952	0.980952	0	0.987722
29	0	1	0.000544	0.959717	0	0.980952	0	0.987722
30	0	1	0.000544	0.960261	0	0.980952	0	0.987722
31	0	1	0.002178	0.962439	0.008571	0.989524	0	0.987722
32	0	1	0	0.962439	0.002857	0.992381	0	0.987722
33	0	1	0.000544	0.962983	0	0.992381	0	0.987722
34	0	1	0.004899	0.967882	0	0.992381	0	0.987722
35	0	1	0.002178	0.97006	0	0.992381	0	0.987722
36	0	1	0.000544	0.970604	0	0.992381	0	0.987722
37	0	1	0.001633	0.972237	0	0.992381	0	0.987722
38	0	1	0	0.972237	0	0.992381	0	0.987722
39	0	1	0.002722	0.974959	0	0.992381	0	0.987722
40	0	1	0.003266	0.978225	0.00381	0.99619	0	0.987722
40+	0	1	0.021775	1	0.00381	1	0.012278	1

Appendix D: BAH Rates for Sample Ranks

AFB	BAH w/ Dependents				BAH w/o Dependents			
	E4	E9	O3	O6	E4	E9	O3	O6
Andrews	$758	$1,174	$1,196	$1,456	$618	$890	$1,005	$1,228
Pope	$518	$715	$716	$942	$381	$548	$605	$791
Moody	$485	$719	$719	$906	$346	$556	$609	$792
WPAFB	$514	838	$753	$1,086	$362	$636	$636	$902
Offutt	$516	$881	$781	$954	$372	$671	$662	$809
Little Rock	$438	$747	$673	$975	$360	$576	$572	$780
Tinker	$429	$691	$671	$965	$307	$524	$562	$779
Randolph	$560	$826	$825	$1,017	$395	$644	$706	$860
FE Warren	$463	$791	$673	$982	$371	$608	$571	$837
Hill	$563	$661	$637	$823	$408	$661	$637	$823
Luke	$554	$938	$949	$1,197	$448	$711	$794	$994
Davis-Monthan	$561	$919	$869	$1,202	$409	$692	$724	$1,010
Nellis	$692	$1,026	$991	$1,197	$510	$789	$837	$995
Travis	$684	$1,014	$938	$1,132	$502	$753	$773	$952
McChord	$554	$869	$820	$1,098	$400	$657	$688	$919
Elmendorf	$789	$1,277	$1,257	$1,494	$549	$950	$1,004	$1,232

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Vita

Captain Eldrick L. Hill was born on 7 October 1970 in Norfolk, Virginia. He graduated from Ely High School located in Ft. Lauderdale, FL in 1989 and entered undergraduate studies at the United States Air Force Academy in Colorado Springs, Colorado. He graduated with a Bachelor of Science Degree in Civil Engineering and was commissioned on 2 June 1993.

His first assignment was at the Air Force Academy as a graduate assistant where he taught college algebra and coached the Air Force Academy Prepatory School in football. He left the Air Force Academy in August of 1994 and was reassigned to the 325th Civil Engineers Squadron at Tyndall AFB, Florida. There he worked as a section commander, base programmer, and SABER project manager. On 15 June 1997, while stationed at Tyndall, he married his wife, Keisha, who is a native of Dayton, OH. He entered the Graduate School of Engineering, Air Force Institute of Technology in August 1997.

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